

IN THE CLAIMS:

Claims 1-36 (Cancelled)

- 1 37. (Currently Amended) A direct oxidation fuel cell, comprising
- 2 (A) a catalyzed membrane electrolyte, having an anode aspect and a cathode
- 3 aspect;
- 4 (B) a fuel cell housing enclosing said fuel cell with an anode chamber being
- 5 defined between said anode aspect of the catalyzed membrane electrolyte and an exterior
- 6 portion of said cell housing;
- 7 (C) a direct fuel feed into [[an]]said anode chamber that has no liquid exit port
- 8 such that liquid that is present in said anode chamber cannot exit said anode chamber ex-
- 9 cept across said catalyzed membrane electrolyte;
- 10 (D) at least one open gaseous effluent release port [[located in said anode
- 11 chamber in close proximity to said anode aspect of the catalyzed membrane electrolyte]],
- 12 which is in substantially direct [[fluid]] gaseous communication with the ambient envi-
- 13 ronment allowing effective release of anodically-generated gaseous effluent from said
- 14 fuel cell as said gaseous effluent is generated; and
- 15 (E) a load coupled across said fuel cell, providing a path for electrons pro-
- 16 duced in electricity generating reactions of said fuel cell.

- 1 38. (Previously Presented) The direct oxidation fuel cell as defined in claim 37
- 2 wherein a substance delivered by said direct fuel feed into a liquid-closed volume in the
- 3 anode chamber is up to 100% fuel.

- 1 39. (Previously Presented) The direct oxidation fuel cell as defined in claim 38
- 2 wherein said fuel is methanol.

1 40. (Previously Presented) The direct oxidation fuel cell as defined in claim 37
2 wherein fuel is delivered by said direct fuel feed into said anode chamber without anode
3 liquid recirculation.

1 41. (Previously Presented) The direct oxidation fuel cell as defined in claim 37
2 wherein water produced at said cathode is not actively collected or pumped to said anode
3 chamber.

1 42. (Currently Amended) The direct oxidation fuel cell as defined in [claim 27] claim
2 37 wherein gaseous effluent traveling out of said fuel cell through said gaseous effluent
3 release port is at least partially comprised of carbon dioxide.

1 43. (Previously Presented) The direct oxidation fuel cell as defined in claim 37
2 wherein at least a portion of one wall of said anode chamber is gas permeable and liquid
3 impermeable.

1 44. (Currently Amended) A direct oxidation fuel cell, comprising:
2 (A) a catalyzed membrane electrolyte having an anode aspect and a cathode
3 aspect;
4 (B) a fuel cell housing with an anode chamber being defined between said an-
5 ode aspect of said catalyzed membrane electrolyte and an exterior portion of said cell
6 housing, and fuel being delivered to, but not actively recirculated from, said anode cham-
7 ber; and
8 (C) a gaseous anodic product removal component disposed between said cata-
9 lyzed membrane electrolyte and at least a portion of the interior wall of the anode cham-
10 ber for effective release of anodically generated gaseous effluent substantially directly to
11 the ambient environment.

1 45. (Currently Amended) A direct oxidation fuel cell system, comprising:
2 (A) a direct oxidation fuel cell having:

3 (i) a catalyzed membrane electrolyte, having an anode aspect and a
4 cathode aspect;
5 (ii) a fuel cell housing enclosing said fuel cell with an anode chamber
6 being defined between said anode aspect of the catalyzed membrane electrolyte and an
7 exterior portion of said cell housing;
8 (iii) a direct fuel feed into [[a liquid-closed volume in said]] an anode
9 chamber, having no liquid exit, such that [[liquid]] fuel that enters into the chamber by
10 the direct fuel feed cannot exit the chamber except across said catalyzed membrane elec-
11 troltye; and
12 (iv) at least one open gaseous effluent release port located in said an-
13 ode chamber in close proximity to said anode aspect of the catalyzed membrane electro-
14 lyte, which is in substantially direct gaseous communication with the ambient environ-
15 ment and through which [[carbon dioxide]] anodically generated gaseous effluent is al-
16 lowed to be released from said fuel cell housing;
17 (B) a fuel source coupled to said anode chamber; and
18 (C) means by which current can be collected from the fuel cell and conducted
19 to a load, whereby electricity is generated by said fuel cell as fuel is delivered to said an-
20 ode chamber without external pumping of cathodically-generated water and without ac-
21 tive water removal elements.

1 46. (Currently Amended) A direct oxidation fuel cell, comprising:
2 (A) a catalyzed membrane electrolyte assembly having an anode aspect and a
3 cathode aspect and
4 (B) means for outporting gasses away from the anode aspect of the fuel cell
5 substantially directly to the ambient environment which means for outporting gasses is
6 disposed in close proximity to said anode aspect of the catalyzed membrane electrolyte
7 assembly.

- 1 47. (Withdrawn) A gas management component for use in a direct oxidation fuel
- 2 cell having a catalyzed membrane electrolyte with an anode aspect and a cathode aspect,
- 3 comprising:
 - 4 an element substantially comprised of a gas-permeable, liquid-
 - 5 impermeable material, which element is disposed in close proximity to the anode aspect
 - 6 of the catalyzed membrane electrolyte assembly.
- 1 48. (Withdrawn) The gas management component as defined in claim 47 wherein
- 2 said material is gas-selective in such a manner that it is permeable to anodic effluent gas,
- 3 but is substantially less permeable to oxygen.
- 1 49. (Withdrawn) The gas management component as defined in claim 47 wherein
- 2 said gas management component is made part of a flow field element, providing said
- 3 flow field element with gas releasing properties while effectively delivering fuel to active
- 4 area of the membrane electrolyte.
- 1 50. (Withdrawn) The gas management component as defined in claim 49 wherein
- 2 fuel is delivered to said active area of the membrane electrolyte through an associated
- 3 anodic diffusion layer.
- 1 51. (Withdrawn) The gas management component as defined in claim 49 wherein
- 2 said flow fields encourage removal of anodically-generated gasses such that they are re-
- 3 leased from the direct oxidation fuel cell prior to excessive collection of gaseous anodic
- 4 product within the said anode chamber in said fuel cell.

1 52. (Withdrawn) The gas management component as defined in claim 47 wherein
2 said gas management component is disposed within said fuel cell in such a manner that
3 anodically-generated gasses are released prior to coalescing and impeding the flow of
4 fuel from an associated fuel source into said anode chamber.

1 53. (Withdrawn) A membrane electrode assembly of a direct oxidation fuel cell,
2 comprising:

3 (A) a protonically-conductive, electronically non-conductive catalyzed mem-
4 brane electrolyte;

5 (B) a catalyst disposed on said membrane electrolyte;

6 (C) an anode diffusion layer disposed contiguous to an anode aspect of the
7 membrane electrolyte;

8 (D) a cathode diffusion layer disposed contiguous to a cathode aspect of the
9 membrane electrolyte; and

10 (E) a gas-permeable, liquid-impermeable layer coupled to, or in close prox-
11 imity with said anode diffusion layer.

1 54. (Withdrawn) The membrane electrode assembly as defined in claim 53 wherein
2 said gas-permeable, liquid-impermeable layer is mechanically attached or bonded to said
3 anode diffusion layer.

1 55. (Currently Amended) A direct oxidation fuel cell comprising:

2 (A) a membrane electrode assembly, including:

3 (i) a protonically-conductive, electronically non-conductive catalyzed
4 membrane electrolyte;

5 (ii) a catalyst disposed on said membrane electrolyte;

(iii) an anode diffusion layer disposed contiguous to an anode aspect of the membrane electrolyte;

(iv) a cathode diffusion layer disposed contiguous to a cathode aspect of the membrane electrolyte; and

(B) a gas-permeable, liquid-impermeable layer for releasing gaseous anodic product, coupled in proximity to said anode diffusion layer; and

12 (C) a coupling across said fuel cell to conduct electricity generated by said
13 fuel cell to an associated load; and

14 (D) a fuel cell housing substantially enclosing said fuel cell.

1 56. (Currently Amended) A direct oxidation fuel cell system, comprising:

2 (A) a fuel source;

3 (B) a direct oxidation fuel cell including:

(i) a protonically-conductive, electronically non-conductive catalyzed membrane electrolyte;

(ii) a catalyst disposed on said membrane electrolyte;

(iii) an anode diffusion layer disposed contiguous to the anode aspect of the membrane electrolyte;

10 (iv) a cathode diffusion layer disposed contiguous to the cathode aspect
11 of the membrane electrolyte; and

12 (v) a gas-permeable, liquid-impermeable layer for releasing gaseous
13 anodic product coupled in proximity to said anode diffusion layer;
14 and

15 (vi) a coupling across said fuel cell to conduct electricity generated by
16 said fuel cell to an associated load.

1 58. (Previously Presented) The direct oxidation fuel cell system as defined in claim
2 57 wherein said fuel is methanol.

1 59. (Withdrawn) A method of managing anodic effluent in a direct oxidation fuel
2 cell, said fuel cell having a catalyzed membrane electrolyte with an anode aspect and a
3 cathode aspect, the method including the step of:

4 removing gaseous anodic effluent from a liquid by providing a gas management
5 component comprised substantially of a gas-permeable, liquid-impermeable layer dis-
6 posed in close proximity to the anode aspect of the direct oxidation fuel cell.

1 60. (Withdrawn) The method, as defined in claim 59, including providing said gas-
2 permeable, liquid-impermeable layer in contact with the anode aspect of the membrane
3 electrolyte assembly.

1 61. (Withdrawn) A method of separating anodically-generated gasses in a direct
2 oxidation fuel cell, said fuel cell having a catalyzed membrane electrolyte with an anode
3 aspect and a cathode aspect, and an anode chamber being defined between said anode
4 aspect and an exterior of said fuel cell, the method including the steps of:

5 separating said anodically-generated gasses from a fluid volume of fuel contained
6 within said anode chamber of said fuel cell, without recirculating said volume of fuel.

1 62. (Currently Amended) A direct oxidation fuel cell system, comprising:
2 (A) a fuel source;
3 (B) a direct oxidation fuel cell having a catalyzed membrane electrolyte with
4 an anode aspect and a cathode aspect;
5 (C) a cell housing with an anode chamber defined between the anode aspect of
6 the catalyzed membrane and one exterior portion of said cell housing, with said chamber
7 having no exit port for liquid; and

8 (D) an element disposed between said fuel source and said anode aspect of the
9 direct oxidation fuel cell for controlling the delivery of fuel to the anode aspect of the
10 membrane electrolyte[[direct oxidation fuel cell system]].

1 63. (Previously Presented) The direct oxidation fuel cell system as defined in claim
2 62, wherein said element controls the delivery of fuel without pumps or active recircula-
3 tion mechanisms.

1 64. (Withdrawn) The direct oxidation fuel cell system as defined in claim 62 wherein
2 said fuel source is substantially entirely disposed within said fuel cell.

1 65. (Previously Presented) The direct oxidation fuel cell system as defined in claim
2 62 wherein
3 said fuel source is disposed external to the fuel cell.

1 66. (Previously Presented) The direct oxidation fuel cell system as defined in claim
2 62 wherein
3 a pressure differential exists between the fuel in the fuel source and the anode
4 chamber of the fuel cell.

1 67. (Withdrawn) The direct oxidation fuel cell system as defined in claim 62 wherein
2 said element for controlling fuel delivery includes a pump.

1 68. (Previously Presented) The direct oxidation fuel cell system as defined in claim
2 62 wherein
3 said fuel source contains more than one liquid that may be mixed between the fuel
4 source and the anode of the fuel cell.

1 69. (Previously Presented) The direct oxidation fuel cell system as defined in claim
2 68 wherein

3 said fuel source contains methanol and water.

1 70. (Previously Presented) The direct oxidation fuel cell system as defined in claim
2 62 wherein

3 said fuel source is capable of delivering up to 100% fuel to said fuel cell.

1 71. (Previously Presented) The direct oxidation fuel cell system as defined in claim
2 70 wherein said fuel is methanol.

1 72. (Previously Presented) The direct oxidation fuel cell system as defined in claim
2 62 wherein

3 delivery of said fuel is performed by suction.

1 73. (Previously Presented) The direct oxidation fuel cell system as defined in claim
2 62 wherein

3 said delivery by suction is performed by the action of a capillary network in a po-
4 rous component, which is disposed between said fuel source and said anode of said direct
5 oxidation fuel cell.

1 74. (Withdrawn) A method of delivering fuel to a direct oxidation fuel cell compris-
2 ing the steps of delivering fuel to the anode of the fuel cell in such a manner that the vol-
3 ume of fuel that has been consumed at the anode of the fuel cell is replaced by the same
4 volume of fresh fuel or a fuel and water mixture delivered from a fuel source.

1 75. (Withdrawn) A method of controlling delivery of fuel to a direct oxidation fuel
2 cell system wherein said fuel cell system includes a fuel source, a direct oxidation fuel
3 cell having a catalyzed membrane electrolyte with an anode aspect and a cathode aspect
4 and an anode chamber being defined between said anode aspect and an exterior portion of
5 said direct oxidation fuel cell, said anode chamber not having a port by which liquid can
6 exit the anode chamber, the method including the steps of:

7 providing a mass transport controlling element disposed between the anode aspect
8 of the catalyzed membrane and said fuel source whereby fuel delivery to the fuel cell sys-
9 tem is controlled without pumps or recirculation components.

1 76. (Withdrawn) The method as defined in claim 75 including the further step of
2 disposing said fuel source entirely within said fuel cell.

1 77. (Withdrawn) The method as defined in claim 75 including the further step of
2 disposing said fuel source external to the fuel cell.

1 78. (Withdrawn) The method as defined in claim 75 including the further step of
2 placing fuel in said fuel source under a slight pressure to induce a pressure differ-
3 ential between the fuel in said fuel source and the fuel in the anode chamber of the fuel
4 cell.

1 79. (Withdrawn) The method as defined in claim 75 including the further step of
2 providing in said fuel source more than one liquid; and
3 mixing said liquids between the fuel source and the anode chamber of the fuel
4 cell.

1 80. (Withdrawn) The method as defined in claim 79 wherein said liquids provided to
2 said fuel source include methanol and water.

1 81. (Withdrawn) The method as defined in claim 75 including providing as said fuel,
2 a substance of up to 100% methanol.

1 82. (Withdrawn) The method as defined in claim 81 wherein said fuel substance is
2 methanol.

1 83. (Withdrawn) The method as defined in claim 75 including the further step of de-
2 livering said fuel to said anode chamber by suction.

1 84. (Withdrawn) The method as defined in claim 75 including the further step of de-
2 livering fuel from said fuel source to said anode by the suction action of a capillary net-
3 work in a porous component that is disposed between said fuel source and said anode
4 chamber of said direct oxidation fuel cell.

1 85. (New) A method of delivering fuel to a direct oxidation fuel cell, including the
2 steps of:

3 (A) providing a direct oxidation fuel cell including a catalyzed
4 membrane electrolyte, having an anode aspect and a cathode aspect; and
5 (B) providing a fuel to said anode aspect of said catalyzed mem-
6 brane electrolyte, said fuel comprising concentrated methanol.

1 86. (New) The method according to claim 85 wherein said fuel comprises at least
2 about 50% methanol, by weight.

1 87. (New) The method according to claim 85 wherein said fuel comprises at least
2 about 60% methanol, by weight.

1 88. (New) The method according to claim 85 wherein said fuel comprises at least
2 about 70% methanol, by weight.

1 89. (New) The method according to claim 85 wherein said fuel comprises at least
2 about 80% methanol, by weight.

1 90. (New) The method according to claim 85 wherein said fuel comprises at least
2 about 90% methanol, by weight.

1 91. (New) The method according to claim 85 wherein said fuel comprises at least
2 about 95% methanol, by weight.

1 92. (New) The method according to claim 85 wherein said fuel comprises at least
2 about 99% methanol, by weight.

1 93. (New) The method of delivering fuel as defined in claim 85 including the fur-
2 ther step of providing water to said anode aspect from a water source that is separate
3 from said fuel source.

1 94. (New) A method of delivering fuel to a direct oxidation fuel cell, including the
2 steps of:

3 (A) providing a direct oxidation fuel cell including a catalyzed mem-
4 brane electrolyte, having an anode aspect and a cathode aspect; and

5 (B) providing a fuel to said anode aspect of said catalyzed membrane
6 electrolyte, said fuel consisting essentially of methanol.

1 95. (New) A method of delivering fuel to a direct oxidation fuel cell, including the
2 steps of:

3 (A) providing a direct oxidation fuel cell including a catalyzed mem-
4 brane electrolyte, having an anode aspect and a cathode aspect; and

5 (B) providing a fuel to said anode aspect of said catalyzed membrane
6 electrolyte, said fuel consisting essentially of concentrated methanol.

1 96. (New) A direct oxidation fuel cell, comprising:

2 (A) a catalyzed membrane electrolyte, having an anode aspect and a

3 cathode aspect wherein said anode aspect has no liquid exit;

4 (B) a fuel source for providing fuel to said anode aspect, wherein said

5 fuel comprises concentrated methanol; and

6 (C) a load coupled across said fuel cell, providing a path for electrons

7 produced in electricity-generating reactions of said fuel cell.

1 97. (New) A direct oxidation fuel cell, comprising:

2 (A) a catalyzed membrane electrolyte, having an anode aspect and a

3 cathode aspect, and wherein said anode aspect has no liquid exit;

4 (B) a fuel source for providing fuel to said anode aspect, wherein said

5 fuel consists essentially of concentrated methanol; and

6 (C) a load coupled across said fuel cell, providing a path for electrons

7 produced in electricity-generating reactions of said fuel cell.

1 98. (New) A direct oxidation fuel cell system, comprising:

2

3 (A) a direct oxidation fuel cell having:

4 (i) a catalyzed membrane electrolyte, having an anode aspect

5 and a cathode aspect, and wherein said anode aspect has no

6 liquid exit;

7 (ii) a source of fuel, said fuel comprising concentrated metha-

8 nol for providing fuel to said anode aspect;

9 (B) a fuel cell housing enclosing said fuel cell; and

10 (C) a load coupled across said fuel cell by which current can be col-

11 lected from the fuel cell.

1 99. (New) A direct oxidation fuel cell system, comprising:

2

3 (A) a direct oxidation fuel cell having:

4

(i) a catalyzed membrane electrolyte, having an anode aspect and a cathode aspect, and wherein said anode aspect has no liquid exit;

7

(ii) a source of fuel, said fuel consisting essentially of concentrated methanol for providing fuel to said anode aspect;

9

(B) a fuel cell housing enclosing said fuel cell; and

10

(C) a load coupled across said fuel cell by which current can be collected from the fuel cell.

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100. (New) A method of delivering fuel to a direct oxidation fuel cell, including the steps of:

3

(A) providing a direct oxidation fuel cell including a catalyzed membrane electrolyte, having an anode aspect and a cathode aspect; and

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(B) providing fuel to said anode aspect from a source of fuel having a methanol concentration greater than the 1:1 ratio of methanol:water required by the electrochemical reaction at said anode aspect.

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101. (New) A direct oxidation fuel cell, comprising:

2

(A) a catalyzed membrane electrolyte, having an anode aspect and a
cathode aspect, and wherein said anode aspect has no liquid exit;

4 (B) a source of fuel having a methanol concentration greater than the
5 1:1 ratio of methanol:water required by the electrochemical reaction at the anode
6 aspect for providing fuel to said anode aspect; and
7 (C) a load coupled across said fuel cell, providing a path for electrons
8 produced in electricity-generating reactions of said fuel cell.

1 102. (New) A direct oxidation fuel cell system, comprising:

2
3 (A) a direct oxidation fuel cell having:
4 (i) a catalyzed membrane electrolyte, having an anode aspect
5 and a cathode aspect, and wherein said anode aspect has no liquid exit;
6 and
7 (ii) a source of fuel having a methanol concentration greater
8 than the 1:1 ratio of methanol:water required by the electrochemical reac-
9 tion at said anode aspect for providing fuel to said anode aspect;
10 (B) a fuel cell housing enclosing said fuel cell; and
11 (C) a load coupled across said fuel cell by which current can be col-
12 lected from the fuel cell.